Surgical Education in the United States

Navigating the White Waters

Carlos A. Pellegrini, MD

Members of the American Surgical Association, honored guests, ladies and gentlemen:

I want to thank you all for coming to Boston in record numbers to attend the 126th Annual Meeting of our organization and for choosing to share your time with me this morning. Delivering this address as the president of the oldest and most prestigious organization of surgeons in the United States is a great privilege. Being surrounded by so many personal friends and colleagues makes it all that more meaningful.

I remember vividly when, at the meeting in San Diego some 7 years ago, I received a call from Dr. Frank Spencer, who, on behalf of the nominating committee, told me I was going to be proposed as the new secretary. Knowing as I did that there was no paucity of qualified members for the job, I was surprised and I was deeply humbled. Becoming president, while not entirely a surprise, was still an unbelievable experience. Having now had some years to reflect on this fact, I have moved away from thinking that this was merely an accident in the history of the American Surgical Association. Indeed, as shown by those who have served in this position in the last few years, I believe this reflects a deliberate and courageous decision on the part of the American Surgical Association to incorporate in its leadership individuals with the most diverse backgrounds and ideas. Regardless, I consider myself extremely fortunate for the opportunity to serve in this capacity, and I thank you for the honor you have bestowed on me.

I have often said that, to be happy and productive, a person needs to have a personal anchor. Like ships, human beings need to have something that keeps them steady, something that keeps them upside up when life becomes rocky. I am fortunate to have Kelly, my wife, who while attending to her career has always found the time and the energy to provide me with my personal anchor. Her love and support have been instrumental in getting me here, and I thank her from the bottom of my heart. I cannot speak of my good fortune without recognizing the fact that my own father is here today in the audience. He and my mother, both physicians in a small town in Argentina, were my role models through their service to the community and provided me and my sister with the inspiration to go into medicine. His presence along with that of other members of my family is precious to me.

I was also fortunate to have had great mentors, and there is no better time than this to express my appreciation to them. Professor Juan Acosta, the architect of the theory that explains the pathogenesis of acute biliary pancreatitis and an honorary member of this organization, took me under his wing shortly after I graduated from medical school. He introduced me to the field of clinical research and, more importantly, to the fact that limited resources can be overcome with intelligence, hard work, and perseverance.

My coming to this country was in great part facilitated by Dr. David Skinner, who introduced me to the field of esophagology and, more importantly, to academic surgery in the United States. Were he alive, he would have been proud of my position today.

It was while working with Dr. Skinner that I had the good fortune to meet his own protégé, Dr. Tom DeMeester. It was Tom who launched me into the study of esophageal physiology, the one who taught me how to set up a productive laboratory and who spent countless hours teaching me how to speak in public. Our professional relationship extended far into our personal lives, and I have much to thank him for.

During the 15 years spent at the University of California San Francisco, I was "adopted" professionally by Lawrence Way, one of the leading surgical gastroenterologists in America and a previous vice-president of the American Surgical. He taught me how to operate on difficult patients, and he tried his very best to transfer to me his unique ability to write clearly and concisely.

I also had the privilege of working with Haile Debas, a previous president of the American Surgical, who has proved that a surgeon can be a leading scientist, a great educator, and an influential member of the global community.

Each one of these individuals has helped shape my life and each has helped me reach the next step in my professional life. I am profoundly thankful to them as I am to my former fellows and residents, who have given meaning to my academic life, and to my extended family: the faculty and staff of the Department of Surgery at the University of Washington. I have been blessed to be associated with you all.

Surgical Education in the United States

I chose to speak about surgical education. We are living in a very special moment in the history of surgical education

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in the United States, a moment characterized by profound change. My intent is to discuss some important aspects in the evolution of surgical education, as history is always important to define the future; to describe in broad terms the role played by the American Surgical Association; to describe where we stand today in these "white waters" of change and to share with you some examples that illustrate how we, at the University of Washington, have put into practice some of these changes looking forward into the future. My views reflect my experience of the last 30 years as resident, faculty member and chair of a large university department and my work as member and chair of the Residency Review Committee for Surgery, the American College of Surgeons and the American Board of Surgery. I believe the process of change now has a life of its own. It has been embraced by most stakeholders, and it has brought us to a pivotal point on the history of surgical education.

Surgical Education and the American Surgical Association

The first time the issue of surgical training was discussed in a presidential address of the American Surgical Association was in 1907, by Dr. Dudley Allen when our association was merely 27 years old.[1] In that address, Dr. Allen described the ideal product of surgical training as someone who, " . . . should limit his personal service strictly to those fields in which he is a master . . . " and emphasizing that, "he should know, most of all, in what cases medicine can give relief without operative interference. He should be able to decide wisely, not whether an operation can be done, but whether it offers a better promise of benefit than any other method." He went on to criticize the short training offered by the surgical internships and said that in his opinion, "No training is more valuable to a young man than to serve under a capable surgeon as an assistant in a hospital. Such assistantship should be sufficiently long to give breadth of observation and an opportunity to do operations." The summary conclusion of this presidential address was a recommendation that surgeons be trained thoroughly and broadly. He also recommended that some standard of attainment be determined. In that sense, he recommended that, "The American Surgical Association could create itself a National College of Surgeons and hold annual examinations. Only those passing this examination would be eligible to Fellowship."

It is remarkable that, almost 100 years ago, Dr. Allen was describing the essence of residency training, the need to have a concentrated training experience, and the need to attain and demonstrate competency in yearly examinations by a credible body.

In the next 100 years, the topic of surgical education, surgical training, or the making of a surgeon was to be the *central* topic of at least 17 presidential addresses.[1–17] These addresses discussed a range of topics in surgical education that covered the structure of residency itself, the issue of training generalists and specialists, issues of populating the country's rural areas with adequate numbers of well-trained surgeons, the formation and training of surgeons to serve the needs of the country at war, as was the case particularly around World War I and World War II, and the issues related to competence.

Edward Archibald's address of 1935[6] spoke of the need to certify competence. He compared the U.S. and Canadian systems with those used in England, Edinburgh, Australia, and New Zealand. He explained why the Board of Regents of the American College of Surgeons had steered away from examination and had accepted a lower threshold for admission to fellowship, but he proposed that it was time to set up a system similar to the New Zealand Board of Censors, which carried out examinations similar to our current Certifying examination. This speech was instrumental in the ASA putting together a committee the following year which set the foundation for the creation of the American Board of Surgery in 1937, the body that has since been entrusted with the certification of general surgeons.

Structure of the Residency

The original structure of our residency system was put together by William Halsted at Johns Hopkins in 1889. The structure was based on the German system and, as such, it was autocratic and strictly pyramidal. Indeed, of the 8 residents that were admitted to the first year, 4 were only 1-year positions and of the remaining 4, one became a house surgeon and the other 3 spent long periods of time with no guarantee of becoming staff surgeons.[18] The system aimed at producing one outstanding individual, making "professors of surgery." It succeeded in that leading universities of the time such as Yale, Duke, and the Brigham hospital became populated by Halsted's trainees and adopted the system themselves.

The first major change to the residency structure was the creation of the so-called "rectangular structure" by Edward Churchill, at Massachusetts General Hospital.[18] Churchill criticized the Halsted model in 2 counts: first, somewhat unintended, the model produced a number of poorly trained surgeons (those that left at the completion of one year or sometime thereafter) and he remarked that, "Half a surgical training is about as useful as half a billiard ball." Secondly, that the system depended on a single individual and that the relationship established between a dominant master and a docile apprentice was anti-intellectual and antiscientific. In 1931, when he became chief of the West Surgical Ward at MGH, and based on the experience of the University of Pennsylvania, which had resisted the pressure to adopt the Halsted system and instead had developed a 3-year apprenticeship model, Dr. Churchill proposed a radical change to the board of his hospital.

Instead of the old system at Mass General where there were 8 residents, 6 of which trained for 2 years and 2 who advanced to the 4th year level, he proposed that the number of total residents entering the system be decreased to 6, with 4 of them obtaining the 4-year training, which was assumed to be necessary to produce a fully trained individual and 2 who would be kept for an additional 2 years and who might be destined to remain in the hospital or join as professors other academic institutions. Furthermore, he proposed that his service would be one of, " . . . a group of masters, in which no single personality dominates the institution."[19] In a recent publication describing the impact of Churchill's proposal, Dr.

Hermes Grillo said that the intention was to, "Obviate the subservient status of the trainee under the quasi-parental, self-aggrandizing and authoritarian tutelage which could be so much a part of the apprenticeship," which had been the mode of training until that time.[18]

The "rectangular" system proposed by Churchill would remain, with minor modifications, the core structure of the residency training system in America until the end of the 20th century. It is interesting to note that in this proposal Churchill called for flexibility in tailoring the training to individual's needs as he said, "A frozen five-year curriculum . . . is unthinkable as it allows no latitude for the development of individual interests and proficiencies." Paradoxically, the only modification to Churchill's system has been the mandate by the RRC that the experience of the residents in a program had to be similar between and among all residents of the program, creating the "frozen-curriculum" Churchill had spoken against.

Impetus to Change

Over the last decade of the 20th century, the scheme that we had held for so long started to become stressed by a number of factors. The incorporation of laparoscopy into general surgery and of many other complex procedures in other specialties created a need for longer and more concentrated training in these areas, and a number of postgraduate training opportunities were created to satisfy that need. The move from a discipline-oriented to a disease-oriented practice caused the blurring of traditional boundaries with multiple medical specialties treating a single disease. To survive in this new environment, a surgeon had to master a number of new skills, which required a different kind of training.

The complexity associated with new procedures and devices led trainees, consumers, payers, and patients to demand changes in the training. As a consequence, the institutions in charge of surgical education in this country put in place several programs that addressed the deficiencies that were becoming apparent.

In his 2002 presidential address entitled, "Surgery: A noble profession in a changing world," Haile Debas examined the many changes surgery had undergone in the last decade and underscored the need to re-examine surgical education.[20] At his urging, the council of the American Surgical Association invited the American College of Surgeons, the American Board of Surgery and the Resident Review Committee for Surgery to form a Blue Ribbon Committee on Surgical Education. It was expected that, after examining the multiple forces impacting health care, the group would develop recommendations for change that would enhance the training of surgeons to attend to the needs of the nation and to keep training and research in surgery on the cutting edge in the 21st century.

In January 2005, the recommendations of the committee were published.[21] These recommendations set a solid foundation for the restructuring of many aspects of our educational system. However, as important as the final workproduct of this committee may have been, I believe the most important value of the working group emerged from its heated discussions. These discussions forced the different constituencies to come up with their own answers that addressed the new social needs. As I reflect on it, I think the creation of such a committee by the American Surgical Association will be viewed as a historic event that rekindled interest in surgical education. In addition, the committee encouraged some of its members who had developed strong opinions on topics that were not agreed upon by the entire committee to publish those ideas independently.

I took that challenge and wrote a piece depicting the changes to the structure of residency training that were needed.[22] This was intended to build in the original "rectangular" structure proposed by Churchill, adding the flexibility that he had called for while following the principles articulated by Allen 100 years earlier. This paper calls for a period of time of approximately 3 years to develop a core of surgical principles in the trainee followed by early entry into either general surgery training or some form of specialization. There are some very important principles that support this structure:

1. A period of basic training with clear objectives defined in a curriculum.
2. The possibility to enter a period of research, not just in the basic sciences, but in social sciences and other fields such as communication, professionalism; or the business of medicine; or epidemiology; outcomes studies, etc.
3. Advancement into a specific training module that defines a field of interest at an earlier time in the training, thereby exposing the trainee to a longer training time in a specific area.
4. Development of general surgery to fulfill our country's needs both in rural and urban areas equipping our trainees with the skills necessary to work in those different scenarios.
5. Demonstration of competency at 2 levels, first at the completion of the basic training and then at the completion of the specialty module.

I am delighted to see that, despite the initial criticism that the paper engendered, a lot of progress appears to have been made on some of the principles expressed before. For example, the American Board of Surgery has taken the leadership in the development of a curriculum and has appointed Dr. Richard Bell to lead a team of experts in this undertaking. I am sure the development of the curriculum will lead to the identification of appropriate metrics necessary to measure whether the goals have been achieved. Just last year, the American Board of Surgery successfully negotiated with the American Board of Medical Specialties a way to train vascular surgeons in this exact format as proposed here. Vascular surgeons of this new breed would be skilled to approach vascular disease with traditional surgery as well as catheter-based therapies. The ABS joins the American Board of Plastic Surgery, which some years ago embraced the concept of 3 years of basic surgery and 3 years of specialty and now about half of its programs are configured in this manner. The American Society for Surgery of Trauma is working hard at defining an "Acute Care Surgeon" training paradigm, destined to produce individuals who will care for

the entire spectrum of emergency surgery, and with special skills in critical care. This new individual may have some additional training in neurosurgery, orthopedic surgery, etc., to fulfill critical shortages currently affecting the quality of care of the trauma victims in this country. This is what I referred to as the "white-waters" of today's changes in surgical education. I do not wish to leave anyone with the impression that either this paper or the Blue Ribbon committee's work was the sole force behind the changes I am referring to. For example, plastic surgeons had decided to make their move long before we ever put these ideas on paper. But it has certainly been rewarding for me to see how some of these so-called radical ideas of change are being adopted by different constituencies. So having described the historical background and the current state of affairs what do I see bridging today to tomorrow's surgical education?

Looking Forward

First, I believe we will witness a number of additional changes in the structure of the residency programs. I just shared with you some, but there are several others in varying stages of development. Second, we need to make sure we have a resident-oriented, patient-centered education. Third, I believe we need to integrate simulation formally into surgical education and fourth I believe that we must emphasize 3 of the 6 competencies that are currently underdeveloped: professionalism, communication skills, and the ability to work with others as depicted by practice-based learning; we need to do this with a clear emphasis on the delivery of excellent care, and last we need to integrate these into the new curriculum being developed by the ABS. Let me go through these in some detail.

1. Changes in the Structure of the Residency (the Toronto Model)

Continued changes in the structure of the residency are being planned for the immediate future. For example, University of Toronto is considering proceeding with an experiment that will result in a dramatic alteration of training and which they intend to apply to a limited number of individuals. The principles of the Toronto model are that surgical education will be constructed in a modular system with the objectives linked to a curriculum. In addition, they intend to have a dramatic acceleration of skill acquisition, by using anatomy both in cadavers and virtual reality models with these residents spending considerable time in the laboratory; they intend to diminish the wasted time by eliminating tasks that have no educational purpose and they intend to incorporate meaningful assessment of performance into everyday practice. The system should promote collegiality and "team work" among the residents and intends to accelerate significantly the making of a surgeon. The authors acknowledge the many barriers to this type of radical change, including the need for dedicated teachers, and many others, thus the "experimental" nature of this trial (Reznick R. Personal communication, 2006). Many other structural changes are being studied by other groups.

2. Resident-Oriented, Patient-Centered Education

I referred to the importance of basing the education of surgeons on a well-defined curriculum. I also think we should acknowledge that there is a much more important curriculum, one that educators refer to as the "hidden-curriculum." There is no doubt that actions speak louder than words and that those of us in a leadership position teach a lot more with what we do than with what we say. I just ask that you close your eyes for a moment and remember those from whom you learned the most. You will immediately realize that what you learned, good, bad, or ugly, you learned from what they did to a far greater extent than from what they said.

An old Chinese proverb says, "A teacher affects eternity—one can never know when his influence stops. . . ." It is important that we realize the tremendous importance that role-modeling has in surgical education and the incredible responsibility that especially those of us in this room bear to society in the way we show ourselves to our residents. An off-color remark, a loud voice when exercising authority, or a demeaning comment about referring physicians, particularly when done in private, with a small group of young residents sends a very powerful message to these young minds, "I, a successful surgeon and a leader, think this is all right." On the other hand, attending the preoperative huddle with respect and humbleness, participating actively and respectfully in all aspects of patient care, discussing the patient's values and expectations with the team and making sure that the team knows that this is very important to the surgeon, also sends a powerful message. In my opinion, these attitudes are essential in a faculty member, and I put more and more emphasis on them everyday as I look at appointments, promotions, and rewards to my own faculty. Providing the right example, being the best role model has become, for me, a leading aspect in the recruitment and retention system at the University of Washington.

3. Use of Simulation Technology in Surgical Training

I believe simulation technology is going to play a vital role in the way knowledge and skills are acquired. Learning on the job, particularly surgery, is relatively disorganized, it is unpredictable, it is time-consuming, and it is costly. Learning is not driven by curricular needs; it is instead dependent on clinical needs and subject to available opportunity. Assessment and validation are difficult, and more importantly, patient safety may be jeopardized.

On the other hand, simulation provides for an ideal learning environment. The 3 stages of skill acquisition as described by Fitts and Posner[23] can be reproduced ideally in this environment. Learners can intellectualize the process and get familiar with the tools (cognitive stage), develop the appropriate motor behavior (associative stage), and reach the autonomous stage in which practice gradually results in smooth performance of a procedure or task. With repetition, smooth performance is achieved and the role of the teacher and need for guidance disappears.

Simulation is a simplified reality that is learner-centered. Indeed, it is concerned only with the needs of the learner, not those of the patient. It allows for repeated practice at the learner's own pace and, as it has been appropriately said, "It gives permission to fail, to do so repeatedly and without consequence."

As importantly, most simulators today provide immediate objective evaluation of performance. Finally, simulation lends itself easily to the creation of unusual situations, and the learners can practice them repeatedly at any time.

Designing a skill acquisition module using simulation requires 5 important steps: Defining the skill to be taught; standardizing values for these skills, using appropriate metrics; defining desired levels of performance through definition of criteria; assessing the validity of the simulator; and, very importantly, integrating this process into a defined curriculum.

A number of simulators have now been developed. Mechanical simulators are the most primitive and the cheapest; computer-based simulators with or without associated virtual reality environments can define grades of difficulty and are capable of immediate feedback of performance; hybrid simulators incorporate features of both and create relatively real scenarios.

Mechanical trainers are ideal for initial acquisition of basic skills, familiarization with instruments, appropriate placement of ports, and essential tasks such as suturing, intubation, etc.

Modern computer-based simulators provide an environment to learn basic skills as well as more complex operations such as laparoscopic cholecystectomy, fundoplication, hernia repair, and intestinal resection. The degree of difficulty can be graded, in some, modifications of the normal anatomy are possible, and in some, even issues related to judgment (such as when to convert and the reasons behind it) are taken into consideration. Hybrid simulators provide a physical framework that adds to the reality of the environment. They allow for learning a myriad of different procedures such as upper and lower gastrointestinal endoscopy, breast and abdominal sonography, etc. Some hybrid simulators are able to mimic cardiac, respiratory, vascular, and physiologic reactions to surgical and critical care interventions, and random or specifically planned physiologic or pathologic reactions to an injection. Thus, there is a plethora of simulators today with which to proceed in the teaching of surgeons.

Ericsson, Reznick, and others have challenged the traditional belief that attainment of a master level is synonymous with a unique talent and have instead emphasized the value of repetition in the acquisition of extraordinary skills. They have pointed out that low-level tension enhances learning and that high-level tension, such as can be expected in an operating room environment, highly inhibits motor learning through the creation of anxiety. They believe that, in athletes, musicians, and surgeons, practice is critical to the maintenance of expertise.[24,25] The concept is not new. Indeed, Eugene Pool in his presidential address to this society in 1936 entitled, "The making of a surgeon," said, "It is popularly believed that a surgeon, like a poet or musician, is born, not made; but in reality every detail of his development is the result of long continued effort and concentrated purpose."[7]

Does It Make a Difference?

If we have numerous sophisticated machines to train, does training transfer into the OR? Gallagher and colleagues first showed that residents who had trained in a virtual reality environment (MIST-VR) committed fewer errors during a laparoscopic cholecystectomy than those trained in traditional environments as measured by observers who were blinded to the training type.[26] These results have now been reproduced by other groups[27–29]; thus, the impact of this type of training is established.

Performance

Is performance measurement possible and accurate? Because of the difficulties inherent to evaluating performance in the operating room, Reznick and colleagues have developed the objective structured assessment of technical skills (OSATS) using an inanimate model in which the candidate performs standardized surgical tasks.[30] Gerald Fried at McGill developed the MISTELS (McGill Inanimate System for Training and Evaluation of Laparoscopic Skills), which has been used to evaluate performance among 200 surgeons and trainees from 5 countries and has been able to reliably discriminate between levels of training.[29] Its results are highly concurrent with intraoperative assessments, and the system also shows improvement of scores of novice laparoscopists with improved practice.

In our institution, we have measured technical performance using a device developed by Drs. Lily Chang and Mika Sinanan, called the Blue Dragon.[31] The arms of the Blue Dragon can be attached to regular instruments and through specially designed sensors the device measures forces and torques applied to the instrument by a surgeon. A graphical user interface allows us to synchronize the data with a video clip of each task.

The computer then tracks the movements performed by the right and the left hands of the surgeon in a number of domains including, torque, force, angles, position, etc., at a rate of 30 measurements per second and integrates these data to create three-dimensional projections of the signature of a surgeon. With this system, we are able to see remarkable changes as the residents progress through the different levels of training.

Because simulation provided us not only with the right platform to teach skills, but also with an excellent way to evaluate performance, we, at the University of Washington, developed a strategy to truly integrate simulation into our surgical education program. To that end, we created the Institute of Surgical and Interventional Simulation (ISIS) in partnership with the Dean of the School of Medicine and the hospital and with relatively minimal external support. We developed curricula for the simulators we were acquiring and integrated this curriculum into the residents' training. With the support of Dr. Karen Horvath, our residency program director, we recruited faculty, carved time out of the resi-

dency training, and set it aside to acquire essential technical and psychomotor skills.

Sutherland and colleagues published a review of randomized trials that had addressed the value of surgical simulation.[32] They included 30 publications with some 760 participants, which had analyzed one or another aspect of the validity of simulation in surgical training. Although the results of most papers validated the role of simulation in training, the authors stopped short of endorsing simulation and pointed out that the majority of the studies left a lot to be desired. Indeed, they had a small number of participants, the control arm was not well defined or the appropriate outcome was not measured. In an accompanying editorial, Tom Krummel and colleagues[33] pointed out the difference between *simulators* and *simulation* and concluded that simulation as part of a competency-based curriculum is an effective pedagogical strategy compared with the existing approach.

There are many barriers to adopting a more widespread use of simulation. They include a lack of familiarity, cost, and the very nature of this emerging technology. These barriers can be overcome as we have overcome so many others. In fact, the Regents of the American College of Surgeons, at the request of Dr. Tom Russell, analyzed the role of simulation in surgical education and decided that it should take an active part in its development and regulation. The Division of Surgical Education, led by Dr. Ajit Sachdeva, was charged with the development of a program of accreditation of Surgical Education Institutes at a basic and a comprehensive level.[34] It is the ACS' goal to enhance the use of simulation in education of all surgeons, not just trainees by defining standards and criteria for these centers. With this new venture, the American College of Surgeons becomes an invaluable resource in the process of development of this new educational venue.

4. Emphasis on Professionalism, Communications, and Systems-Based Practice to Improve Quality of Care

As I mentioned earlier, of the 6 competencies that all residents must now acquire, patient care, medical knowledge and lifelong learning have been fairly well developed over the years. On the other hand, communication skills and professionalism have been assumed to be part of the character, or "the make," of medical school graduates, and its further development has not been an essential part of training. Systems-based practice was almost an antithesis of surgeons in the past, as surgery tended to emphasize personal skills over those required to work with all other members of the healthcare team. I submit to you that the application of these 3 competencies significantly enhances the quality of care, which I believe is at the very heart of the national debate. We must instill, early on, in the training of our residents the concept of quality of care, by addressing all of its components: efficiency, efficacy, timely access, equity of access, and costs so that the core concept of quality is embedded into their minds. I want to illustrate with a brief example how we managed to address these 4 components in one aspect of our residents' lives.

UWCores (University of Washington Computerized Rounding and Sign-out System)

UWCores is a computerized rounding and sign out system developed jointly by one of our residents and our program director with the assistance of our Information Technology group. UWCores was born as a result of the challenges in clinical communications that had resulted from the ever-increasing complexity of inpatient care, the notable demand for safety, and the limited duty hours that resulted in an increase in the pool of physicians caring for patients, frequent turnover of inpatient responsibility, and increase pressure on our trainees' time. The idea was to improve communications by standardizing the process, so that we could develop a comprehensive list that would provide a snapshot of the team's patients, which would facilitate rounds by supplying data and by organizing the path of the rounding team. This was an attempt to provide a relatively standard system but one that could be personalized.[35] Clinicians access UWCores from anywhere using a secure internet connection; they enter patient details in their own, condensed style. The application downloads patient data including laboratory reports from hospital information systems hourly. Clinicians can then generate a number of different printed reports, which can include vital signs and laboratory data. Rounding lists are automatically sorted by patient location to streamline resident transit through the wards. Physicians can write their plans in plain English, they can track the number of days a patient has been on antibiotics, or other medications, etc. To study the effects of UWCores in residents' lives, we performed a prospective randomized crossover study.[36] The study was conducted over a 100-day period, it included 14 teams of residents (8 in medicine and 6 in surgery); and because of the crossover design, all 161 residents that participated had a chance to use traditional methods and UWCores. The average daily census was 11 patients per team, with 8 patients for the medicine group and 16 for the surgery teams. Nearly 16,000 patients were rounded upon by all 14 teams in the 12 weeks of the study, with about half of them participating in the UWCores arm of the study. The study was designed to determine the impact of UWCores in residents' workflow and in continuity of care. UWCores improved workflow by significantly decreasing the time residents spent copying data since most of it had been downloaded automatically. This process' time was halved. Team rounds were shortened by 1.5 minutes per patient when using UWCores. The total time saved depended on the patient census and varied from a minimum of 2 to a maximum of 5 hours per week per resident. Subjectively, 82% of the residents reported improved work flow. Continuity of care was also positively impacted. The number of patients missed in rounds due to lack of time or because the patient had been moved during the night or because an emergency admission was not communicated to the residents was halved. The residents reported more time to see patients before rounds, and 70% agreed that UWCores improved their sign-out activities. The use of UWCores resulted in more time available to spend with patients, which the residents felt improved their ability to communicate not only with other residents but also with

patients improving professionalism and interpersonal communications.

Thus, I believe we converted the challenge into an opportunity to improve communications, to address the issue of transfer of care that tags along with the 80-hour week, we were able to give residents back some of their time, and that improved the quality of care. What I believe is more important is that, during the conduct of this study, the residency program was energized by the process: we meant to use information technology to the maximum possible, looking after our residents and keeping a watchful eye on the effects of the change in the quality of care of our patients.

5. Integration of These Activities Into the Residents' Curriculum

As we look forward into the changes that are and that will continue to occur in surgical education over the next months and years, we must make sure they are not just added, but appropriately integrated into the curriculum of our residents. For example, I believe it is imperative that, as the American Board of Surgery develops the new curriculum for training, parallel work with the RRC is done to identify the time and the manner in which simulation technology, or the learning of other competencies will be integrated into the residency training. At the University of Washington, we are actively engaged in determining the way in which these new activities integrate into regular training. Examples, not necessarily final solutions, include the carving out of Wednesday morning for education. To continue to provide clinical services and to better attend to the individual needs of residents, we divide the residents into "juniors" and "seniors," each group dedicating every other Wednesday morning to learning techniques of operations and the science of surgery. We have also created a special rotation of 2 months, which we now implement in every year of the residency during which residents take vacation, complete academic projects, and undergo their technical skills training.[37] We have constructed a library of "techniques" using American College of Surgeons movies and where we encourage our faculty to file their own techniques illustrated with slides or movies, so residents can become familiar with them before scrubbing with them for the first time. The integration of activities is as important, in my opinion, as the activities themselves.

CONCLUSION

Ladies and gentlemen during this address I have tried to provide you with an historical overview of our surgical training system, still regarded by most as the best the world has to offer, with a special emphasis on the role played by the American Surgical Association. I have shared some of my views about the "white waters" through which surgical education has been moving since the turn of the century only 6 years ago; and, I have tried to outline what lies downstream. In doing so, I have thought of the future as the next 5 years. Given the pace of change, looking beyond that may not be either practical or possible for me. As we consider time and relevancy we should reflect on the 1967 presidential address made by Dr. Oscar Creech to this association. He said, "Since good education should meet the needs of the times, perhaps we should consider the times we live in. . . . the essential elements of surgery, then, are decision making, craftsmanship, and the deep personal involvement of the surgeon in the life of his patient. If these elements are preserved in the education of a surgeon, his specialty will remain relevant to the needs of the times".[16] Let us hope we remain relevant to the needs of our times and our society.

I would like to close with a heartfelt thank you to all those who helped me get established in this country. James Bryce, an English scholar who studied the character of American people in the late 1800s through a series of travels in this country was struck by 2 specific qualities: trust and generosity. He attributed these qualities to an ethos of class equality that permeated through all American relations as opposed to the system that was then prevalent in Europe. In his book, "The American Commonwealth"[38]; he wrote, "People meet on a simple and natural footing, with more frankness and ease than is possible in countries where everyone is either looking up or looking down. . . . It gives a sense of solidarity to the whole nation, cutting away the ground for the jealousies and grudges which distract people."

Ladies and gentlemen, I have enjoyed meeting people in this country on that simple and natural footing described by Bryce, I have enjoyed the frankness and the sense of solidarity that he described as well as the trust and the seemingly endless generosity that America and Americans have always had for those who immigrated to its shores. My standing here in this lectern today reflects just that. And for that I am not only grateful, but also extremely proud, as I am now also privileged to call this nation home.

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